

1. A device for detecting volatile chemical reagents in a gaseous sample, comprising:

a fluorescent material comprising at least one polymer-surfactant complex comprising:

5 a fluorescent, ionic conjugated polymer; and

an oppositely charged surfactant;

a contact region where a gaseous sample may associate with the polymer-surfactant complex;

10 a light source that emits light to excite the polymer-surfactant complex and cause it to fluoresce; and

a detector that detects the fluorescent emissions intensity from the polymer-surfactant complex.

2. The device of claim 1, wherein the polymer-surfactant complex is in a polar solution.

15 3. The device of claim 2, wherein the polymer-surfactant complex in solution is in a container with at least a portion of the container being formed of a gas-permeable membrane, and wherein the contact region comprises the gas-permeable membrane.

4. The device of claim 1, wherein the ratio of surfactant molecules per monomer repeat unit of polymer ranges from about 1:1 to about 1:10.

5. The device of claim 1, wherein the ratio of surfactant molecules per monomer repeat unit of polymer is about 1:3.

6. The device of claim 1, wherein the detector comprises a detection device and an output device.

5 7. The device of claim 6, wherein the output device displays the fluorescent emissions intensity.

8. The device of claim 6, wherein the output device transmits the fluorescent emissions intensity to a remote location.

9. The device of claim 6, wherein the output device records the fluorescent 10 emissions intensity for later analysis.

10. The device of claim 6, further comprising:

at least one support structure;

an inlet; and

an outlet.

15 11. The device of claim 10, wherein the support structure encloses the detection device, light source, contact region, and the fluorescent material; and wherein the inlet and outlet allow the gaseous sample pass by the contact region and associate with the polymer-surfactant complex.

12. A device for reusably detecting volatile chemical reagents in a gaseous sample, comprising:

a fluorescent material comprising at least one polymer-surfactant complex comprising:

5 a fluorescent, ionic conjugated polymer; and

an oppositely charged surfactant;

a contact region where the gaseous sample may associate with the polymer-surfactant complex;

10 a light source that emits light to excite the polymer-surfactant complex and cause it to fluoresce;

a detector that detects the fluorescent emissions from the polymer-surfactant complex; and

a vacuum device configured to evacuate the gaseous sample from the region of the polymer-surfactant complex after the complex has been exposed to the gaseous sample.

15 13. The device of claim 12, wherein the polymer-surfactant complex is disposed as a thin film.

14. The device of claim 13, wherein the polymer-surfactant film is a bilayer in which a film of the fluorescent, ionic conjugated polymer is covered by an outer layer of the oppositely charged surfactant.

15. The device of claim 13, wherein the polymer-surfactant film is a solid precipitate that is formed by complexing the fluorescent, ionic conjugated polymer with a sufficient quantity of the oppositely charged surfactant.

16. The device of claim 15, wherein the polymer-surfactant film is prepared by 5 spin coating the solid precipitate from a solvent.

17. The device of claim 15, wherein the polymer-surfactant film is cast from the solid precipitate.

18. The device of claim 15, wherein the solid precipitate is formed by 10 complexing the polymer and surfactant in a ratio of surfactant molecules per monomer repeat unit of polymer of about 1:1.

19. The device of claim 12, wherein the detector comprises a detection device and an output device.

20. The device of claim 19, wherein the output device displays fluorescent 15 emissions intensity received by the detection device from the polymer-surfactant complex.

21. The device of claim 19, wherein the output device records fluorescent emissions intensity received by the detection device from the polymer-surfactant 15 complex.

22. The device of claim 19, wherein the output device transmits fluorescent emissions intensity received by the detection device from the polymer-surfactant complex to a remote location.

23. The device of claim 13, wherein the fluorescent material comprises an array of polymer-surfactant complex films.

24. The device of claim 23, wherein each polymer-surfactant complex film comprises a different polymer-surfactant complex, and wherein the array of polymer-surfactant complex films and the detector are configured such that the detector can detect the presence and concentration of various volatile chemical reagents.